The section on live stock runs on lines similar to those adopted for crops; tables are given showing the composition of feeding stuffs, typical rations, and methods of computing variants, together with much information about the animals themselves. Altogether the book will be found very useful for reference purposes, and, as it is well indexed, it is very easily consulted.

Mineralogy. By Dr. F. H. Hatch. Fourth edition, entirely rewritten and enlarged. Pp. ix+253 (London: Whittaker and Co., 1912.) Price 4*s*. net.

IN this "fourth edition" a revision has for the first time been undertaken. The consequent doubling of its size and price is fully justified by the enhanced value of the work, which for twenty years has been handicapped by its modest size. The addition of eighty pages to the section dealing with descriptive mineralogy has allowed a much fuller treatment of the ores, this portion being trebled in length, while ore-dressing processes (electromagnetic, oil-concentration, &c.), find brief reference under properties of minerals. The portion on optical properties, formerly relegated to a couple of pages, is enlarged sevenfold, thus permitting of an explanation of double-refraction phenomena. Coupled with the fuller description of rock minerals, this renders the book of some use in microscope work. The use of the letters **a, b, c** to indicate elasticity axes is regrettable, owing to the likelihood of confusion (both in writing and speaking), with the *a, b,* and *c* crystallographic axes; the substitution of X, Y, Z, as adopted in Iddings's "Rock Minerals," avoids this difficulty.

The arrangement of the descriptive portion under the four heads Rock-forming Minerals, Ores, Other Salts, and Gems is convenient, if inconsistent, and it is supplemented by a list of mineral species, chemically classified. We are surprised to find so small a book including among "the more important minerals" metacinnabarite, hauerite, &c. The treatment of mineral names is not always satisfactory; thus nowhere is mention made of the name kupfernickel, so commonly used as a synonym of niccolite; dialogite appears in the text as such, but in the index as diallogite. Wolfram and wolframite (though used as synonyms) are used apparently indiscriminately in the text, but are separately indexed.

The typography is good and misprints very rare (on p. 57 *statical changes* evidently means *charges*), but some illustrations of crystals, like Figs. 63 and 75, might be improved. R. F. G.

Revolving Vectors, with Special Application to Alternating-current Phenomena. By Prof. Geo. W. Patterson. Pp. vi+89. (New York: The Macmillan Company; London: Macmillan and Co., Ltd., 1911.) Price 4*s*. 6*d*. net.

THIS brief but excellent little treatise can be recommended as a good introduction to the modern topic of revolving vectors, and particularly to the use of the symbolic notation in the development of the subject. It opens with a brief historical note on the discovery in 1797, by Wessel, of the use of the imaginary $\sqrt{-1}$ as an operator having a geometric function of rotation through a right angle. From this the author leads on to the treatment of complex quantities, and their use in representing harmonic motion. The latter half of the book deals with the application to alternating electric currents and other electrical matters. It is satisfactory that the author conforms to the convention adopted by the International Electrotechnical Commission in its recent session in Turin, in using the counter-clockwise sense of rotation as positive.

LETTERS TO THE EDITOR.

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. *No notice is taken of anonymous communications.]*

Contour Diagrams of Human Crania.

IN the last number of *Biometrika* (viii., 1, 2, 1911) Prof. Karl Pearson has edited and published a very valuable paper by the late Dr. Crewdson Benington on cranial type-contours. The work is based on long series of skulls of various races, *e.g.* English of the seventeenth century (from the Whitechapel Plague Pit), modern English (Royal Engineers), various Negro races from the Congo, Guanche, Egyptian, Eskimo, and the prehistoric Cro-magnon skull. For each series three typical contours are selected, viz.:—(1) a "transverse vertical," passing through the auricular points and the apex of the skull; (2) a sagittal or median section; and (3) a horizontal section through the glabella; and in each case all the individual skulls of a series are combined into a single "type" by a process of arithmetic averages. Lastly, the diagrams thus obtained are reproduced on tissue-paper, so that one may be superposed upon another, and the characteristic differences easily compared.

I venture to think that we may go a little further, and may, by a simple device, get a new series of diagrams which shall throw into still greater relief the presence and the amount of essential difference of form: for, after all, comparison of the two superposed contours is a matter of individual judgment, and there is a lack of fixity and precision in our interpretation of the result. Moreover, it is obvious that we have, in the first instance, no clear and easy distinction between differences of size and differences of form.

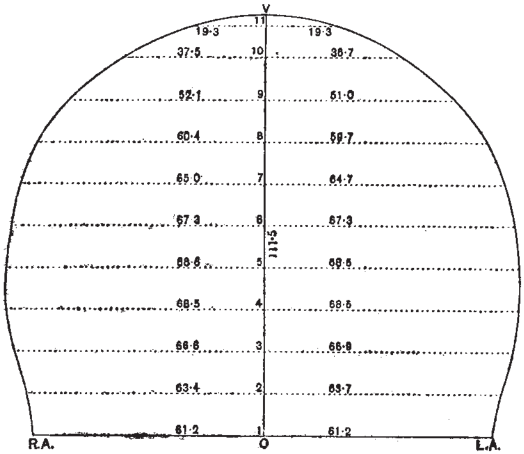

FIG. 1.—English crania, 17th century. Transverse contour.

Taking the case of the transverse, or vertical inter-auricular, section of the skull, Dr. Benington's diagrams represent it for us as in Fig. 1, where a median vertical axis is divided into ten equal parts (the uppermost of these also by a point one-quarter of a division from the apex), and at each of these points of division the horizontal distance to the contour-line is measured and recorded. Thus we are in possession of such tabular statements as the following:—

		A	B
Vertical Height		111·5	121
11	Transverse diameters	19·3	20
10		37·5	37
9		52·1	55
8		60·4	67
7		65·0	72
6		67·3	74
5		68·6	74
4		68·5	72
3		66·6	69
2		63·4	64
1		61·2	62

Dimensions (in mm.) of the transverse cranial section (right side). A English skulls of 17th century; B, Cro-magnon skull.

In order to isolate differences of form from differences of general magnitude, I have reduced all measurements to the scale of a standard vertical height, of 100 mm., with the following result :—

Vertical Height ...	A	B	C	D	E	F	G	H
	100	100	100	100	100	100	100	100
11 ...	17·3	16·5	18·1	18·1	16·0	12·7	15 5	17·1
10 ...	33·6	30·6	33·5	34·7	31·9	27·4	32·0	33·7
9 ...	46·7	45·5	45·5	47·5	46·0	41·6	46·0	47·6
8 ...	54·2	55·4	52·9	55·5	54·6	48·9	53·5	55·3
7 ...	58·3	59·5	56·8	58·9	59·1	54·4	56·9	58·9
6 ...	60·4	61·2	58·8	60·1	60·9	57·0	58·3	60·1
5 ...	61·5	61·2	59·5	60·3	61·7	58·2	58·6	60·4
4 ...	61·4	59·5	59·0	59·3	61·5	58·3	58·2	60·1
3 ...	59·7	57·0	57·2	57 3	59·0	57·6	55·8	57·3
2 ...	56·9	52·9	54·5	54·3	55·7	56·0	53·3	54·4
1 ..	54·9	51·2	52·0	53·3	54·5	56·0	51·4	52·5

Horizontal dimensions of the transverse cranial section, reduced to a common vertical height.

A, English (17th century); B, Cro-magnon; C, Living English; D, Egyptian; E, Guanche; F, Eskimo; G, Congo Negro (Fernando Vas, 1864); H, Congo Negro (Batetelu).

Lastly, we may write any of these in terms of percentages of any other; and so, for instance, we may take the seventeenth-century English skull as our type, and translate the data for all the rest into percentage proportions thereof, as follows :—

	A	B	C	D	E	F	G	H
11 ...	100	95·4	104·6	104·6	92·7	73·4	89·6	98·8
10 ...	100	91·1	99·7	103·3	94·9	81.6	95·4	100·3
9 ...	100	97·5	97·4	101·7	98·5	89·1	98·4	101·9
8 ...	100	102·2	96·9	102·4	100·8	90·2	98·7	102·0
7 ...	100	102·0	97·4	101·0	101·4	93·3	97·6	101·0
6 ...	100	101·3	97·3·	99·5	100·9	94·4	96·5	99·5
5 ...	100	99·5	96·7	98·0	100·3	94·7	95·3	99·8
4 ...	100	96·9	96·1	96·6	100·1	95·0	94·8	97·9
3 ...	100	95·5	95·8	96·0	98·8	96·5	93·5	96·0
2 ...	100	92·9	95·8	95·4	98·0	98·5	93·7	95·6
1 ...	100	93·3	94·7	97·1	99·2	102·1	93·6	95·6
Mean ...	100	97·1	97·5	99·6	98·7	91.7	95·2	98·9

Relative horizontal dimensions of the transverse cranial section.

A, English (17th century); B, Cro-magnon; C, Living English; D, Egyptian; E. Guanche; F, Eskimo; G, Congo (Fernando Vas); H, Congo (Batetelu).

When these numbers are translated into curves (plotting heights vertically and percentage-breadths horizontally), then, I think, they show us in a striking way the nature and degree of such differences as exist between the several type-contours. The contour of our standard of comparison (seventeenth-century English) is now represented by a vertical straight line, and all the others by appropriate curves. It is obvious that if a skull differ from the standard in some simple way, as, for instance, by greater or less breadth, uniformly distributed, its curve will approximate to the form of a straight line parallel to the vertical; if the tendency to broaden or to narrow increase from below upwards, then the curve will be more or less of a straight line set at an angle to the vertical; while if the changes are more complicated or irregular, then the new curve will be more or less sinuous. Indeed, the sinuosity of the curve will be a rough measure of the fundamental differences in form between it and the standard of comparison.

As my object here is to illustrate a method rather than the results derived from it, I will deal very briefly with the curves shown in the following figures.

In Fig. 2 the sinuosity of the Cro-magnon curve (1) indicates striking differences from the standard in the essential form of its contour; it is much narrower below, in the auricular region, then gets broader, and, finally, it is sharply constricted near the apex. The Guanche skull (2) is nearest to the Englishman's, but is narrower above. The Negro (Fernando Vas) (3) is everywhere narrower, and its curvature has a trend similar to that of the Guanche. The Eskimo (4), broad below, narrows to a great degree in the apical region.

In Fig. 3 we compare with the seventeenth-century Englishman (6) the living Englishman (Royal Engineers) and (5) the Egyptian. The latter, by its somewhat greater sinuosity, shows a greater difference than the former, it being narrow in the lower half of the section and broader or more flattened above; but the differences are obviously not nearly so great as, for instance, those between the English skull and the Eskimo or the Cro-magnon. At the same time, the differences between the Egyptian and the English skulls are opposite in character to all those illustrated in the former figure.

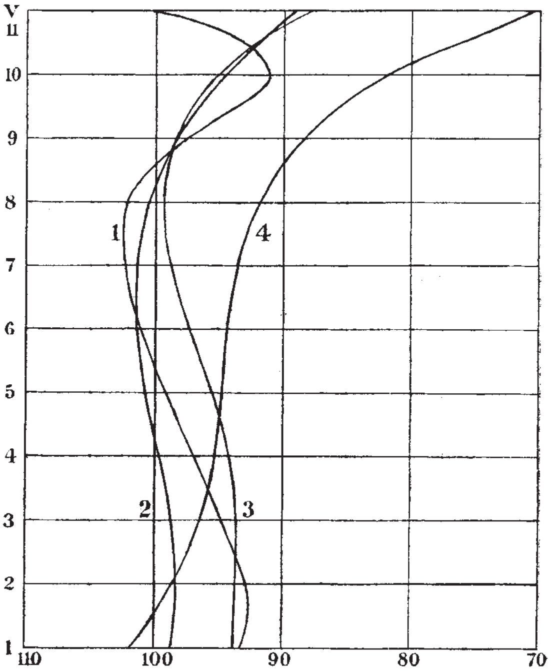

FIG. 2.

In the next figure (4) we compare (1) the transverse contour of the living Englishman with the Englishman of the seventeenth century, and (2) two Congo tribes one with another. (The curves in this instance have been slightly smoothed.) Save for a slight accentuation of apparent differences in the immediate neighbourhood of the apex,

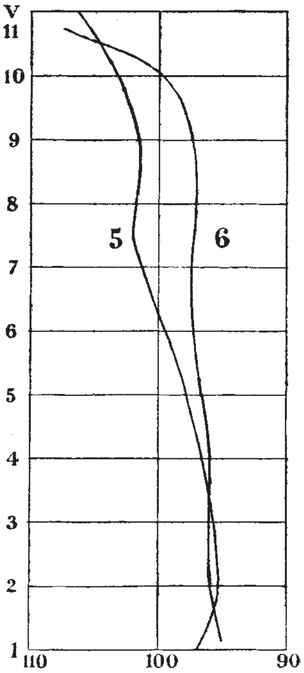

FIG. 3.

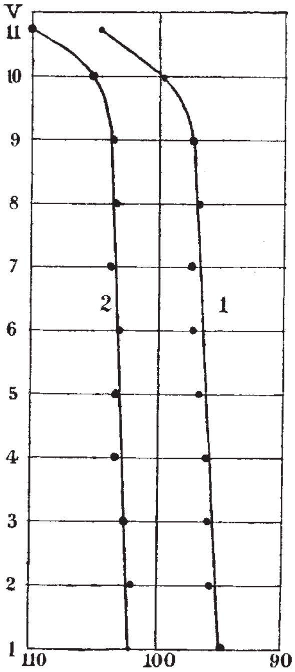

FIG. 4.

the curves are in each case all but straight, and are nearly parallel to the vertical. They show (1) that the skull of the living Englishman, that is to say, of the Royal Engineers, is a little narrower than that of the seventeenth-century Londoner, the difference being greatest across the ears, and that, in like manner, the skull of the Batetelu Negro is a little broader than that of the Negro from Fernando Vas. In both cases the general similarity, or identity of type, between the two skulls under comparison is clearly brought out.

Lastly, we may use the method to compare the left side of the skull with the right. And so we find (Fig. 5) that

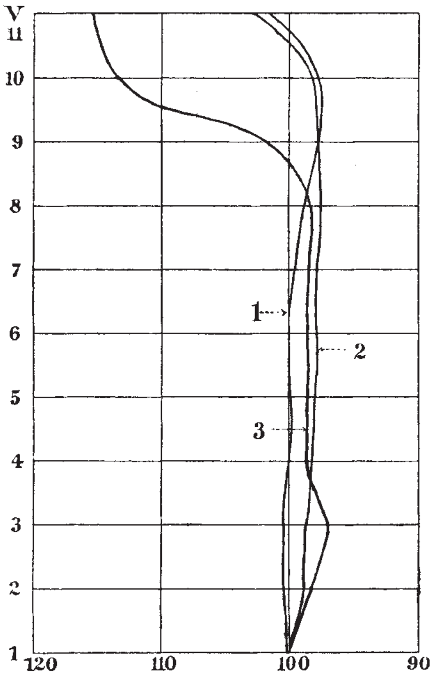

FIG. 5.

in the English skull there is approximate identity throughout most of the section, the left side being narrower in the upper portion only; in the Negro (Fernando Vas) the left side is throughout inferior, while the Cro-magnon skull is markedly unsymmetrical, the left side being the narrower below, but expanded or flattened above in a striking degree.

January 27. D'ARCY W. THOMPSON.

Microscope Stands.

THE correspondence which has ensued on the interesting article on the above subject which appeared in NATURE of December 21, 1911, has afforded much material for reflection. There must be a best possible design for a microscope stand, but it is evident that the one required by the expert amateur is different from that which is acceptable and advantageous to the professional in the laboratory. The former demands, and can with advantage utilise, many refinements that never appeal to the latter. The best English microscopes undoubtedly supply the needs of the expert—that appears to be admitted—and assuming that the design of the Continental instrument is preferred in the laboratory, it might be that the worker would derive fuller benefit from his microscope if only some additional conveniences were at his disposal and he knew how to use them.

So far, the correspondence has been contributed by experienced technical microscopists; but the views of the other side would be welcome and informing.

To revert to the article in question, no one who has had the use of a centring substage would be disposed to accept a centring adjustment to the nosepiece in preference. It is stated that the latter adjustment is provided in the Continental models, but I am unable to find a centring nosepiece listed or described in either of the catalogues of the two leading German manufacturers of microscopes, excepting only in connection with petrological microscopes. Some centring device is admitted to be necessary, and continual working with condensers having large aplanatic cones soon reveals the necessity for the centring substage.

It is suggested that the correction collar fitted to objectives is superior to the rackwork draw-tube for adjusting for varying thicknesses of cover glasses. This is quite correct; but probably not more than 1 per cent. of the objectives that are sold have correction collars, and in consequence of the perfection in which even students' lenses are now made, the sensitiveness to thickness of cover glass necessitates careful adjustment by variation of tube length. There is another important feature of the mechanical draw-tube, and that is it gives a maximum and a minimum body length which permits of the use of any objective, whether corrected for the short or the long tube, though this is subsidiary.

As to the standardisation of the substage fittings, a definite size is given by the Royal Microscopical Society, and if this is adhered to there can be very little trouble about interchanging. It has to be remembered that one-thousandth of an inch in the diameter of a tube makes all the difference between a tight and a slack fitting; tube fittings are particularly liable to variation in consequence of slight bending. Objectives do not always interchange, though all are ostensibly made to the standard size; but the alterations needed are exceedingly slight, and the differences in the substage apparatus of standard size are rarely such as cannot be quickly corrected. It seems reasonable to assume that if it be good to have a standard size for eyepieces and objectives, it is equally advantageous to have one for the substage. The English makers work loyally to the one standard of the Royal Microscopical Society, while the Continental makers each have two or three different ones.

At the bottom of all questions relating to the use of the microscope is the urgent necessity for systematic teaching in the elementary technique of the instrument. It is not unusual to meet men of eminence who are constantly working with microscopes who do not even know that a substage condenser requires to be focussed. How is it possible that the refinements of the English microscope can appeal to their students? F.R.M.S.

The Inheritance of Mental Characters.

To the discussion on the question of the inheritance of mental characters (*v.* NATURE, December 28, 1911, p. 278) as one who takes an interest in the subject, but can lay no claim to having expressly studied it, I should be glad to be allowed to contribute a few experiences.

In a girls' primary school the writer knew a child who from the age of five until eleven (when her education was complete) was, owing to her daring athletic feats, a torture to her teachers. They were in a perpetual worry lest she should break her bones or her neck. Punishment—and it was pretty liberal—was of no use; when their backs were turned she was at it again. They—and some of them were old teachers—had never met one like her. The other children, about 150 in number, were normal. This one had no peculiar environment, no special opportunities. But her father was a professional showman. She, like the Greek Œdipus, had never seen him, nor did her mother ever speak of him. He had been "raised" on a small farm. His brothers were commonplace workmen. The teachers were unaware of the showman parentage. Some few of us knew, and watched with interest the developments.

This case seems an instance of the inheritance of an acquired taste.

True it, no more than any case that can be brought forward, is not beyond question; for just possibly in the child—as very likely previously in the father—the mere abnormal potentiality was there. This perhaps some accident revealed to her. We always like to do what we